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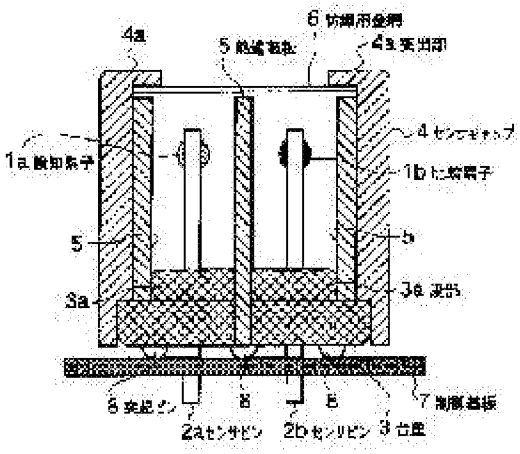
(54) CATALYTIC COMBUSTION TYPE GAS SENSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a catalytic combustion type gas sensor which can obtain stable sensor outputs.

SOLUTION: In this catalytic combustion type gas sensor for calibrating combustible gases through detection by a detection element 1a and a comparison element 1b a combustion heat generated when the gas is burnt, sensor pins 2a and 2b spaced by a fixed distance are set erecting to a base 3. The detection element 1a is fixed to the side of one end of the sensor pin 2a, and the comparison element 1b is fixed to the side of one end of the sensor pin 2b. A heat- shielding plate 5 is arranged substantially at a middle position of the detection element 1a and the comparison element 1b. A sensor cap 4 is provided for covering the heat-shielding plate 5, the base 3 and the sensor pins 2a and 2b. A control substrate 7, to which the side of the other end of each of the sensor pins 2a and 2b is set, is arranged, and three projecting pins 8 are formed to the base 3 of the side of the control substrate 7.



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CLAIMS

[Claim(s)]
[Claim 1]In a contact burning gas sensor which carries out measuring of the combustible gas by detecting combustion heat generated when burning gas by detector element and a comparison element, Set up to a plinth the 1st and 2nd holddown members that carried out constant distance alienation, and said detector element is fixed to said 1st holddown member, Fix said comparison element to said 2nd holddown member, and a heat shielding member is arranged to the abbreviated mid-position of said detector element and said comparison element, A contact burning gas sensor having formed a wrap container for this heat shielding member, said plinth, and said 1st and 2nd holddown members, having formed a substrate which attaches said 1st and 2nd holddown members, and forming two or more heights in said substrate side of said plinth.
[Claim 2]The contact burning gas sensor according to claim 1 setting up each distance of distance of said each element and said heat shielding member, and distance of said each element and said container so that a sensor output to this distance may serve as an approximately regulated value.
[Claim 3]The contact burning gas sensor according to claim 1 or 2 said heat shielding member and said each element having been provided in a wrap wire gauze by said container, and setting up distance of said each element and said wire gauze so that a sensor output to this distance may serve as an approximately regulated value.
[Claim 4]The contact burning gas sensor according to claim 2 making distance of said each element and said heat shielding member more than abbreviated 3mm.
[Claim 5]The contact burning gas sensor according to claim 2 or 4 making distance of said each element and said container more than abbreviated 4mm.
[Claim 6]A contact burning gas sensor of claim 3 making distance of said each element and said wire gauze more than abbreviated 4mm thru/or claim 5 given in any 1 paragraph.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In this invention, the combustion heat generated in a detector element and a comparison element when burning gas is detected.
Therefore, the sensor structure which can obtain the especially stable sensor output is provided about the contact burning gas sensor which carries out measuring of the combustible gas.

[0002]
[Description of the Prior Art]As shown in drawing 9, on the platinum coil (20 micrometers - 50 micrometers) (it corresponds to a heater) 51, a contact burning gas sensor applies the catalyst 53 of an alumina system, and forms the element 1, The bridged circuit 60 as shown in drawing 10 using the resistance R11 and the resistance R12, using the detector element 1a and the comparison element 1b as this element 1 is constituted.
[0003]Gamma-alumina or alpha-alumina is used for the comparison element 1b as a catalyst, using as a catalyst the gamma-alumina with which the detector element 1a supported palladium (Pd). The catalyst 53 generates heat according to the calorific value of the platinum coil 51, and acts as a catalyst to combustion of gas.
[0004]And the voltage of the power supply E was impressed to the terminal a and the terminal b, and the output voltage V is taken out from the terminal c and the terminal d as a sensor output.
[0005]That is, a contact burning gas sensor carries out measuring of the combustible gas by detecting the combustion heat generated when the catalyst 53 is made to heat with the heat generated with the platinum coil 51, gas is burned efficiently and gas burns by the detector element and a comparison element.
[0006]In this contact burning gas sensor, as shown in drawing 11 (a), to the plinth 3 provided in four in a sensor cap. The sensor pin 2a which fixed the detector element 1a, and sensor pin 2b which fixed the comparison element 1b are setting up, and the tip part of the sensor pin 2a and 2b is attached to the control board 7. The sensor pin 2a and 2b are attached to the control board 7 so that

the control board 7 and the bottom of the plinth 3 may become parallel. It changes into the state where this mounting state was attached normally.

[0007]

[Problem(s) to be Solved by the Invention]However, if it is in the conventional contact burning gas sensor, when attaching the sensor pin 2a and 2b to the control board 7, as shown in drawing 11 (b), a contact burning gas sensor may be accidentally leaned and attached to the control board 7. For example, when among the plinths 3 are a barricade etc., it attaches to the control board 7 and inclination occurs in the case. For this reason, attitude difference will occur in the detector element 1a and the comparison element 1b, and a sensor output will change delicately.

[0008]The sensor output characteristic in the state where it attached normally with the state where leaned the contact burning gas sensor to the control board 7, and it was attached to drawing 12 is shown. When a contact burning gas sensor is leaned and attached to the control board 7, drawing 12 shows a base output moving to a plus direction and falling as compared with the sensor output at the time of attaching a sensor output normally. When a delicate sensor output -- a contact burning gas sensor detects low-concentration gas especially -- is being processed, change of the sensor output by the attitude difference of the detector element 1a and the comparison element 1b poses a big problem.

[0009]Then, this invention makes it a technical problem to provide the contact burning gas sensor which can obtain the stable sensor output.

[0010]

[Means for Solving the Problem]In order to solve an aforementioned problem, this invention was considered as the following composition. In a contact burning gas sensor which carries out measuring of the combustible gas by detecting combustion heat generated when an invention of claim 1 burns gas by detector element and a comparison element, Set up to a plinth the 1st and 2nd holddown members that carried out constant distance alienation, and said detector element is fixed to said 1st holddown member, Fix said comparison element to said 2nd holddown member, and a heat shielding member is arranged to the abbreviated mid-position of said detector element and said comparison element, A wrap container was formed for this heat shielding member, said plinth, and said 1st and 2nd holddown members, a substrate which attaches said 1st and 2nd holddown members was formed, and two or more heights were formed in said substrate side of said plinth.

[0011]According to the invention of claim 1, the 1st and 2nd holddown members that carried out constant distance alienation are set up to a plinth, Since fixed a detector element to the 1st holddown member, a comparison element was fixed to the 2nd holddown member, a substrate which attaches the 1st and 2nd holddown members was formed and two or more heights were formed in the substrate side of a plinth, When attaching the 1st and 2nd holddown members to a substrate, two or more heights contact a substrate and a contact burning gas sensor stops inclining to a substrate. Therefore, since influence of attitude difference of a detector element and a comparison element is lost, a stable sensor output can be obtained.

[0012]In the contact burning gas sensor according to claim 1, an invention of claim 2 set up each

distance of distance of said each element and said heat shielding member, and distance of said each element and said container so that a sensor output to this distance might serve as an approximately regulated value.

[0013]Since according to the invention of claim 2 each distance of distance of each element and a heat shielding member and distance of each element and a container was set up so that a sensor output to this distance might serve as an approximately regulated value, Thermal conductivity from each element to a heat shielding member and thermal conductivity from each element to a container can fall substantially, and a sensor output stable in the long run can be obtained.

[0014]In the contact burning gas sensor according to claim 1 or 2, said heat shielding member and said each element were provided in a wrap wire gauze by said container, and an invention of claim 3 set up distance of said each element and said wire gauze so that a sensor output to this distance might serve as an approximately regulated value.

[0015]According to the invention of claim 3, since distance of each element and a wire gauze formed in a container was set up so that a sensor output to this distance might serve as an approximately regulated value, thermal conductivity from each element to a wire gauze can fall substantially, and a sensor output stable in the long run can be obtained.

[0016]An invention of claim 4 made distance of each element and a heat shielding member more than abbreviated 3mm in the contact burning gas sensor according to claim 2.

[0017]According to the invention of claim 4, a sensor output stable in the long run can be obtained by having made distance of each element and a heat shielding member more than abbreviated 3mm.

[0018]An invention of claim 5 made distance of each element and a container more than abbreviated 4mm in the contact burning gas sensor according to claim 2 or 4.

[0019]According to the invention of claim 5, a sensor output stable in the long run can be obtained by having made distance of each element and a container more than abbreviated 4mm.

[0020]An invention of claim 6 made distance of each element and a wire gauze more than abbreviated 4mm in a contact burning gas sensor of claim 3 thru/or claim 5 given in any 1 paragraph.

[0021]According to the invention of claim 6, a sensor output stable in the long run can be obtained by having made distance of each element and a wire gauze more than abbreviated 4mm.

[0022]

[Embodiment of the Invention]Hereafter, the embodiment of the contact burning gas sensor of this invention is described in detail with reference to drawings.

[0023](A 1st embodiment) Drawing 1 is detailed structural drawing of the contact burning gas sensor of a 1st embodiment. The sensor pin 2a and 2b which the plinth 3 which has the step 3a is formed in the contact burning gas sensor shown in drawing 1, and set up to this plinth 3 at the plinth 3, and inserted in the plinth 3 are being fixed. The sensor pin 2a and sensor pin 2b correspond to the 1st and 2nd holddown members of this invention, and prescribed distance alienation is carried out and they are arranged at abbreviated parallel. The detector element 1a is fixed to the end side of the sensor pin 2a, and the comparison element 1b is being fixed to the end side of sensor pin 2b.

[0024]In the approximately middle of the sensor pin 2a and sensor pin 2b, the heat shielding plate 5

(it corresponds to the heat shielding member of this invention) set up to the plinth 3 is arranged, and this heat shielding plate 5 is more expensive than the sensor pin 2a and 2b, and covers the heat generated with each element of the detector element 1a and the comparison element 1b.

[0025]Right above the heat shielding plate 5 and the sensor pin 2a, and 2b, the wire gauze 6 for explosion protection is arranged, and this wire gauze 6 for explosion protection is attached to the lobe 4a of the cylindrical sensor cap 4. The sensor cap 4 corresponds to the container of this invention, and covers the sensor pin 2a, 2b, the detector element 1a, the comparison element 1b, the plinth 3, and the heat shielding plate 5.

[0026]The sensor pin 2a and other end side of 2b is attached to the control board 7. The three hemispherical projecting pins 8 are formed in the field by the side of the control board 7 of the plinth 3, i.e., a clamp face, at abbreviation regular intervals.

[0027]According to the contact burning gas sensor of a 1st embodiment constituted in this way, when attaching a gas sensor to the control board 7, the three projecting pins 8 formed in the plinth 3 contact the control board 7, and the physical relationship of the detector element 1a, the comparison element 1b, and the control board 7 is determined. A contact burning gas sensor stops namely, inclining to the control board 7. Therefore, since the influence of the attitude difference of the detector element 1a and the comparison element 1b is lost, the stable sensor output can be obtained.

[0028]It replaces with the hemispherical projecting pin 8 shown in drawing 1, and it may be the three projecting pins 9 of the shape of flatness as shown in drawing 2, and such a projecting pin 9 can also acquire the effect of a 1st embodiment, and the same effect. A projecting pin may be the projection of triangular shape or other shape, without being limited to these projecting pins 8 and 9.

[0029]In a 1st embodiment, although it was considered as the three projecting pins 8, two pieces or the four or more piece projecting pin 8 may be formed, without being limited to this number. The effect is size when forming the two projecting pins 8, and it provides near the right and left ends of the plinth 3.

[0030](A 2nd embodiment) The contact burning gas sensor of a 2nd embodiment of this invention is explained below. Drawing 3 is detailed structural drawing of the contact burning gas sensor of a 2nd embodiment. Drawing 4 is a plan of the contact burning gas sensor of a 2nd embodiment. Drawing 5 is the figure which looked at the contact burning gas sensor of a 2nd embodiment from the direction of A.

[0031]In drawing 3 thru/or drawing 5, the portion and identical parts which are shown in drawing 1 attach numerals for the same part **, and the detailed explanation is omitted.

[0032]As the sensor pin 2a is shown in drawing 4, it comprises sensor pin 2a-1 and sensor pin 2a-2, and sensor pin 2b comprises sensor pin 2b-1 and sensor pin 2b-2.

[0033]The detector element 1a is arranged [in the approximately middle of sensor pin 2a-1 and sensor pin 2a-2] at the nearly tip of a pin, and this detector element 1a is being fixed to sensor pin 2a-1 and sensor pin 2a-2 by the two gold streaks 10.

[0034]The comparison element 1b is arranged [in the approximately middle of sensor pin 2b-1 and sensor pin 2b-2] at the nearly tip of a pin, and this comparison element 1b is being fixed to sensor pin

2b-1 and sensor pin 2b-2 by the two gold streaks 10.
[0035]Each of the detector element 1a and the comparison element 1b consists of the platinum coil 51 and the catalyst 53 applied on this platinum coil 51, as shown in drawing 9. The platinum coil 51 is good in width being 20 micrometers - 50 micrometers, and it being 30 micrometers preferably. Gamma-alumina or alpha-alumina is used for the comparison element 1b as a catalyst, using as a catalyst the gamma-alumina with which the detector element 1a supported palladium (Pd), for example.
[0036]A diameter is 0.6 mm and each of the sensor pin 2a and 2b consists of an alloy of copper (Cu) and nickel (nickel), for example. Each of the plinth 3, the sensor cap 4, and the heat shielding plate 5 consists of Nylon, for example. The wire gauze 6 for explosion protection consists of a 316100 meshes of SUS wire gauze, for example.
[0037]And a bridged circuit as shown in drawing 10 is constituted using the above detector element 1a and comparison element 1b. ** is connected with the resistance R11 and R12 which were connected with the detector element 1a connected in series and the comparison element 1b in series in parallel, and the bridged circuit is constituted, as shown in drawing 10. The bridged circuit 60 takes out the change in resistance of the detector element 1a which originates in the combustion heat generated when burning gas by the detector element 1a and the comparison element 1b, and is generated, and the change in resistance of the comparison element 1b as a sensor output from the node of the detector element 1a and the comparison element 1b.
[0038]The distance of the direction of X is the distance of the detector element 1a (or comparison element 1b) and the heat shielding plate 5 in drawing 3. The distance of the direction of Y is the distance of the detector element 1a (or comparison element 1b) and the sensor cap 4. the distance of a Z direction -- the detector element 1a (or comparison element 1b) and explosion protection -- public funds -- it is distance with the net 6.
[0039]Here, in the contact burning gas sensor of an embodiment, the relation between an all directions-oriented distance and a sensor output is shown in drawing 6 thru/or drawing 8. Drawing 6 shows the relation between the distance of the direction of X, and a sensor output. Drawing 7 shows the relation between the distance of the direction of Y, and a sensor output. Drawing 8 shows the relation between the distance of a Z direction, and a sensor output.
[0040]A horizontal axis expresses the distance of a corresponding direction with drawing 6 thru/or drawing 8, and a vertical axis expresses a sensor output (mV) with it. Isobutane concentration (ppm) was detected in this example.
[0041]In the example shown in drawing 6, it turns out that the thermal conductivity from the detector element 1a (or comparison element 1b) to the heat shielding plate 5 falls, and the sensor output value is large by enlarging distance of the direction of X at the time of a gas sensitive detector. For example, when the distance of the direction of X is 3 mm, a sensor output is about 30 mV, and when this distance is not less than 3 mm, a sensor output serves as an approximately regulated value.
[0042]In the example shown in drawing 7, it turns out that the thermal conductivity from the detector element 1a (or comparison element 1b) to the sensor cap 4 falls, and the sensor output value is large

by enlarging distance of the direction of Y at the time of a gas sensitive detector. For example, when the distance of the direction of Y is 4 mm, a sensor output is about 33 mV, and when this distance is not less than 4 mm, a sensor output serves as an approximately regulated value.

[0043]enlarging distance of a Z direction in the example shown in drawing 7 -- the time of a gas sensitive detector -- the explosion protection from the detector element 1a (or comparison element 1b) -- public funds -- it turns out that the thermal conductivity to the net 6 falls and the sensor output value is large. For example, when the distance of a Z direction is 4 mm, a sensor output is about 33 mV, and when this distance is not less than 4 mm, a sensor output serves as an approximately regulated value.

[0044]The distance of the direction of X namely, by the distance of not less than about 4 mm and a Z direction being the distance of not less than about 3 mm and the direction of Y not less than about 4 mm, Since the thermal conductivity from each elements 1a and 1b to the heat shielding plate 5, the thermal conductivity from each elements 1a and 1b to the sensor cap 4, and the thermal conductivity from each elements 1a and 1b to the wire gauze 6 for explosion protection fall substantially, the sensor output stable in the long run can be obtained. Since the projecting pin 8 is formed, the effect becomes large rather than the effect of a 1st embodiment.

[0045]It is most preferred that the distance of about 4 mm and a Z direction shall be the distance of about 3 mm and the direction of Y about 4 mm for the distance of the direction of X from a viewpoint of miniaturizing a contact burning gas sensor.

[0046]It is good only also considering the distance of the direction of X as not less than about 3 mm, good only also considering the distance of the direction of Y as not less than about 4 mm, or good only also considering the distance of a Z direction as not less than about 4 mm. This invention is applicable also to the combination of the distance of the direction of X, the distance of the direction of Y, and the distance of a Z direction.

[0047]

[Effect of the Invention]According to the invention of claim 1, the 1st and 2nd holddown members that carried out constant distance alienation are set up to a plinth, Since fixed the detector element to the 1st holddown member, the comparison element was fixed to the 2nd holddown member, the substrate which attaches the 1st and 2nd holddown members was formed and two or more heights were formed in the substrate side of a plinth, When attaching the 1st and 2nd holddown members to a substrate, two or more heights contact a substrate and a contact burning gas sensor stops inclining to a substrate. Therefore, since the influence of the attitude difference of a detector element and a comparison element is lost, the stable sensor output can be obtained.

[0048]Since according to the invention of claim 2 each distance of the distance of each element and a heat shielding member and the distance of each element and a container was set up so that the sensor output to this distance might serve as an approximately regulated value, The thermal conductivity from each element to a heat shielding member and the thermal conductivity from each element to a container can fall substantially, and the sensor output stable in the long run can be obtained.

[0049]According to the invention of claim 3, since the distance of each element and the wire gauze formed in the container was set up so that the sensor output to this distance might serve as an approximately regulated value, the thermal conductivity from each element to a wire gauze can fall substantially, and the sensor output stable in the long run can be obtained.
[0050]According to the invention of claim 4, the sensor output stable in the long run can be obtained by having made distance of each element and a heat shielding member more than abbreviated 3mm.
[0051]According to the invention of claim 5, the sensor output stable in the long run can be obtained by having made distance of each element and a container more than abbreviated 4mm.
[0052]According to the invention of claim 6, the sensor output stable in the long run can be obtained by having made distance of each element and a wire gauze more than abbreviated 4mm.

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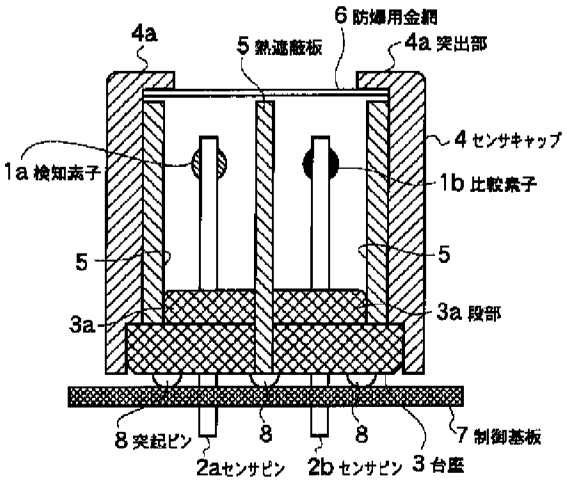
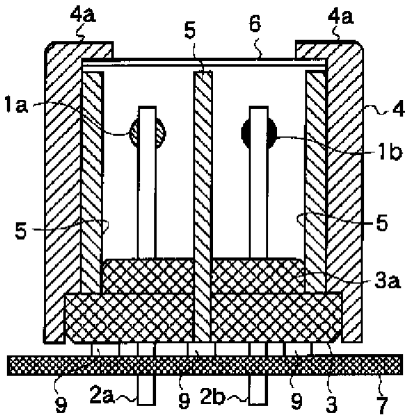
DRAWINGS

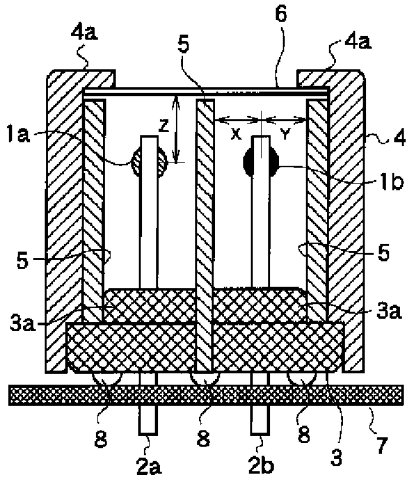
[Drawing 1]



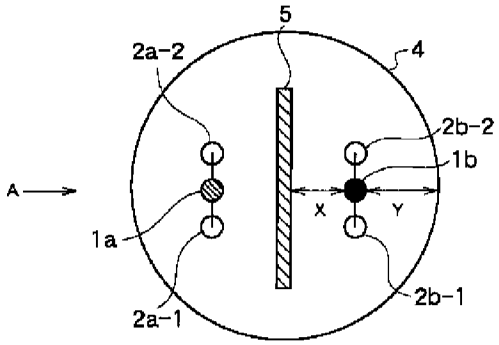
[Drawing 2]



[Drawing 3]



[Drawing 4]



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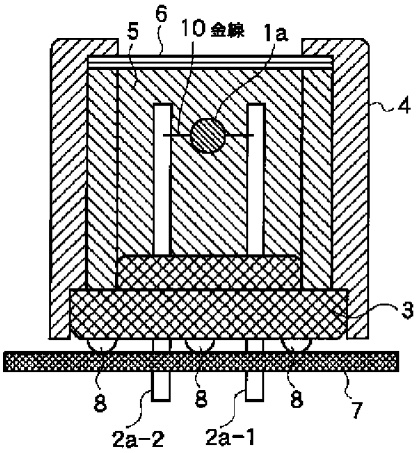

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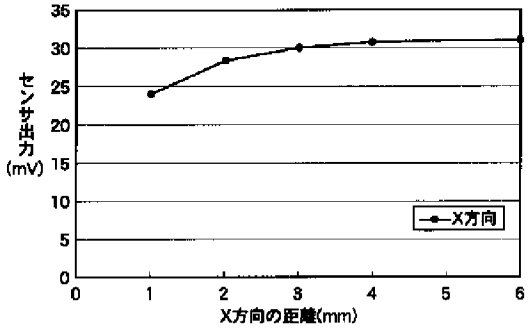
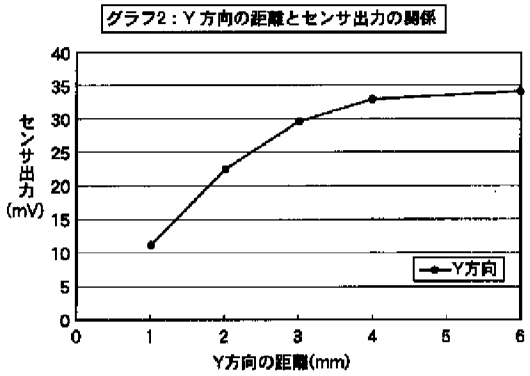
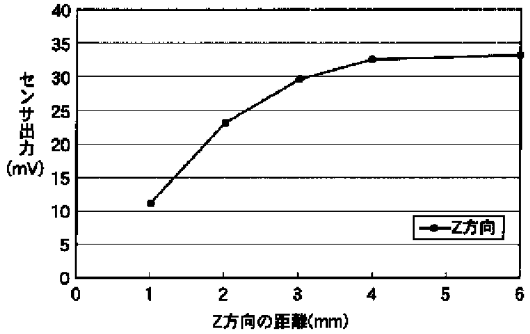


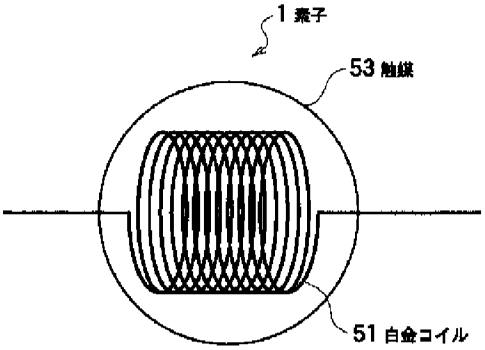
[Drawing 7]



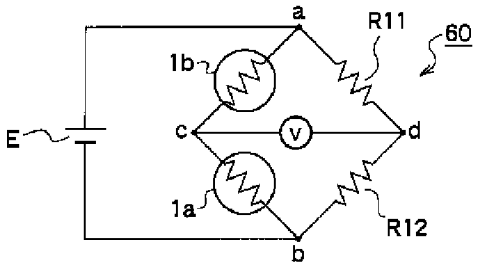
[Drawing 8]



[Drawing 9]



[Drawing 10]



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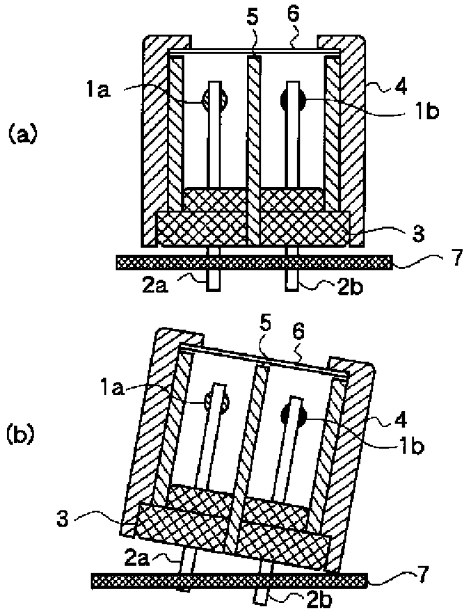

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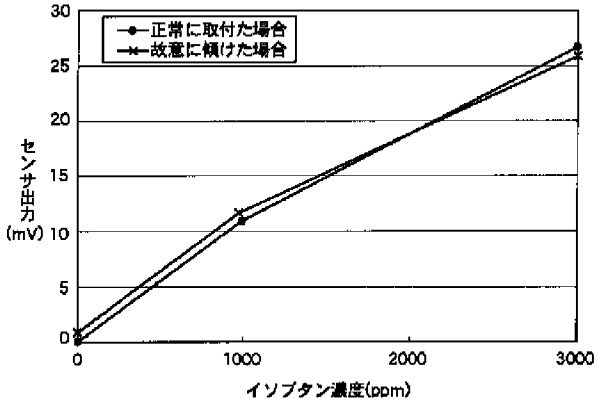

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